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The Advantages and Disadvantages of Seeking Commonality in Military Equipment

Increasingly, the Army and the Department of Defense (DoD) are developing families of systems built around common, base platforms so that variants share many key components. For instance, the Army has procured Stryker armored combat vehicles, which is a family of vehicles sharing a common base platform and thus most key components. Commonality can increase operational flexibility and reduce procurement, logistical, and training costs and burdens. However, commonality can also decrease design freedom and occasionally negatively affect operational capability by forcing design compromises to accomplish multiple missions, none ideally. And commonality can actually increase costs if it overly increases design complexity or if some variants end up with excessive functionality. These factors suggest that the pursuit of commonality should be informed by careful analyses.

To help the Army determine how to more effectively incorporate the full range of commonality considerations in weapon system development and acquisition, RAND Arroyo Center assessed the advantages and disadvantages of commonality and developed a decision aid to help Army policymakers manage these tradeoffs. The study drew upon historical and literature analyses as well as case studies of commercial and military efforts to exploit commonality.

Types of Commonality

Operational needs and tradeoffs should drive the type of commonality pursued. There is no single “best” option that will apply to all types of common systems:

- A *hybrid* approach combines multiple capabilities that are normally separated into a single system.
- A *modular* system allows functions to be exchanged within one system.

Key Points

- Operational needs and the effects of commonality on them should drive the type of commonality pursued.
- RAND Arroyo Center identified four categories of components for which it is often advantageous to pursue commonality.
- Commonality can either decrease or increase costs, depending upon the net effect of multiple factors.
- Arroyo developed a decisionmaking aid to improve acquisition decisions regarding commonality.

- A *family* refers to a group of systems that share a platform.
- A *differentiated* system is distinguished by its unique platform, components, and capabilities in pursuit of specialization.

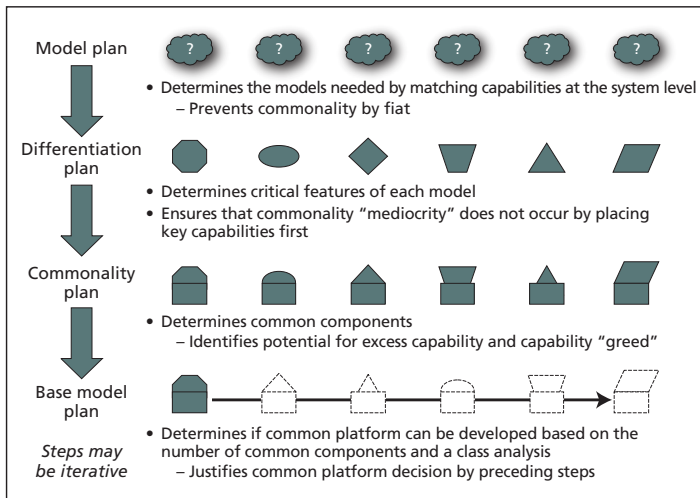
Hybrids offer operational flexibility but often at the cost of greater weight and some compromised capabilities. Modular systems offer the option of leaving behind modules that are not needed for the current mission, reducing the “mobility burden.” This might make sense for capabilities that are expected to be used in environments with predictable lead times for changing components. A family approach eases the logistics burden, but it could leave some models with design sacrifices (e.g., if the platform weight class produces sacrifices for some missions).

Commonality Can Decrease or Increase Total Costs

Although greater commonality is often associated with lower costs, Arroyo’s research shows a subtler

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Capability-Based Commonality Decisionmaking Aid



NOTE: The shapes in the figure represent the transition through the application of the decision aid from requirements with unknown physical attributes (the cloud question marks), to known features (the varying geometric shapes), to common components potentially based on a common platform (the common rectangle with varying shapes on top of it).

picture. Depending upon how it is implemented and the specific applications, commonality can also increase costs. To assess the systemic value of commonality, the Army also needs to understand how the use of common items affects several different costs categories, including development, acquisition, sustainment, training, and personnel.

Arroyo identified four general categories of components for which it could be financially advantageous to pursue commonality:

- *Complex, expensive items* present opportunities for reducing costs by spreading the R&D cost over multiple systems (e.g., a new family of weapon platforms like the Future Combat System).
- *High-demand items that have similar specifications* can lead to reduced costs through economies of scale, lower inventory levels, increased purchasing power, and lower order costs (e.g., certain vehicle engines, tires).

- *Items that are burdensome for operations or maintenance training* should be made common to save on the training burden and personnel needs.
- *Logistically burdensome items*, such as tires, tracks, engines, and transmissions, tend to dominate bulk storage, which can be problematic given the Army’s storage constraints for mobile field warehouses.

However, the advantages of commonality must be traded off against the Army’s desire for specialized or maximum operational capabilities.

Analytic Method to Guide Commonality Decisionmaking

Arroyo developed an aid, based on commercial manufacturing models, to guide decisionmaking concerning commonality during the equipment design process. The figure shows the four parts of the aid.

The materiel developer can use the aid to inform the requirements development process and whether to pursue differentiated systems. The designer can use this aid to choose among design strategies and balance the inevitable tradeoffs during the design process. The procurer can use the aid to audit the progress of development. And the logistician, trainer, and operator can use the aid to stay informed of relevant tradeoffs and to determine whether designers and procurers remain cognizant of their primary concerns.

History has shown that commonality can lead to outcomes that are both negative and positive. Informed decisions about commonality require nuanced analyses throughout the design, development, and deployment of a system or a group of systems, as well as formal tracking of outcomes. Using objective, informed analyses, the Army can determine which specific components should be made common, as well as when families of systems and hybrid approaches should be pursued. A decisionmaking aid like the one referenced here can assist in making better decisions by ensuring that all tradeoffs are carefully considered. ■

This research brief describes work done by the RAND Arroyo Center and documented in *Commonality in Military Equipment: A Framework to Improve Acquisition Decisions*, by Thomas Held, Bruce Newsome, and Matthew W. Lewis, MG-719-A, 2008 (available at <http://www.rand.org/pubs/monographs/MG719.html>). This research brief was written by Kristin J. Leuschner. The RAND Corporation is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND’s publications do not necessarily reflect the opinions of its research clients and sponsors. **RAND®** is a registered trademark.

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